CLAIMS

1. Method for selecting a subset of sites within a set of candidate sites for activating one or more radio stations in a telecommunications network, comprising the steps of:

building an initial solution (200), comprising a subset of sites, obtained starting from a potential network configuration comprising as active the whole set of candidate sites; and

optimising (400, 500, 1000, 2000, 2400) the initial solution by activating "inactive" sites and/or deactivating "active" sites, in order to minimise a predetermined cost function (F_C) for the solution,

characterised in that

said steps of building (200) and optimising (500, 1000, 2000) the initial solution are adapted to define solutions having a geographic coverage ($A^{service}_{Nactivecells}$) wider than a predefined minimum coverage area (A_{min}) and are adapted to manage an amount of traffic ($T^{carried}_{Nactivecells}$) greater than a predefined minimum value of expected traffic (T_{min}).

2. Method according to claim 1, characterised in that said step of optimising (500, 1000, 2000) comprises the steps of:

i) generating a neighbourhood of solutions of the current solution (500) by activating "inactive" sites and/or by deactivating "active" sites;

ii) computing (1000) a predetermined cost function (F_C) of solutions belonging to the built neighbourhood and selecting the best solution of the neighbourhood as current solution (2000), depending on the respective cost values;

iii) determining a set of solutions (1400, 1700, 1900) in the current solution neighbourhood; and

iv) iteratively applying steps i)-iii) till a predefined processing time is elapsed or till a solution whose cost is lower than a pre-determined value is obtained within said set of solutions (1400, 1700, 1900), and designating as final solution one among the obtained solutions within said set of solutions (1400, 1700, 1900).

3. Method according to claim 2, characterised in that it comprises the steps of:

- verifying (2500), upon each iteration, that in the set of solutions (1000) in the current solution neighbourhood at least one solution has

  - a geographic coverage area ($A^{service}_{Nactivecells}$) greater than the predefined minimum coverage area (A_{min}) and is adapted to manage an amount of traffic ($T^{carried}_{Nactivecells}$) greater than the predefined minimum value of expected traffic (T_{min}), or

  - a coverage area with relaxed constraints within a predefined threshold and is adapted to manage a amount of traffic ($T^{carried}_{Nactivecells}$)greater than the predefined minimum expected traffic value (T_{min}) or is adapted to manage an amount of traffic ($T^{carried}_{Nactivecells}$) with relaxed constraints within a predefined threshold and has a geographic coverage area ($A^{service}_{Nactivecells}$) greater than the predefined minimum coverage area (A_{min}); and

- in case such check is not satisfied for a predefined number of iterations, building (2900) a solution satisfying these conditions through a random activation of one or more cells/sites starting from the

current solution and consequently returning to step i) of generating the neighbourhood of solutions (400), applied to the thereby built solution.

4. Method according to claim 2 or 3, wherein the predefined minimum coverage area (A_{min}) and the predefined minimum expected traffic (T_{min}) are defined depending on the coverage area and traffic guaranteed by the potential network configuration.

5. Method according to claim 4, wherein solutions with relaxed constraints are allowed for which the coverage area ($A^{service}_{Nactivecells}$) and the amount of managed traffic ($T^{carried}_{Nactivecells}$) related to the selected subset of sites are included within a relaxation threshold of the predefined requirements of minimum coverage area (A_{min}) and minimum expected traffic (T_{min}).

6. Method according to claim 5, wherein the step of determining the set of neighbourhood solutions comprises at least one of the following steps:

- storing (1400) the best solution in terms of cost that shows a geographic coverage area ($A^{service}_{Nactivecells}$) that is greater than said minimum coverage area (A_{min}) and is adapted to manage an amount of traffic ($T^{carried}_{Nactivecells}$) that is greater than said minimum expected traffic value (T_{min});
- storing (1700) the best solution in terms of cost for which the coverage area ($A^{service}_{Nactivecells}$) and the amount of managed traffic ($T^{carried}_{Nactivecells}$) are included within said relaxation threshold of predefined requirements of minimum coverage area (A_{min}) and minimum expected traffic value (T_{min});
- storing (1900) the best solution in terms of cost

that belongs to the solutions neighbourhood, but does not comply with the requirements in previous items.

7. Method according to any one of the previous claims, wherein the initial solution comprises (205) the cells belonging to a predefined list of compulsorily active cells (34) and the cells deemed as "not able to be turned off" due to a higher cell load (η_{cell}) than a predefined threshold load in the potential network configuration.

8. Method according to claim 7, wherein, in case said initial solution has not a coverage area ($A^{service}_{Nactivecells}$) that is greater than said minimum area (A_{min}) and an amount of traffic ($T^{carried}_{Nactivecells}$) that is greater than said minimum traffic value (T_{min}), said solution is enriched (215) by the cells deemed in the "able to be turned off" status due to a lower cell load (η_{cell}) than a predefined threshold load in the potential network configuration, but not having in such configuration any adjacent cell in soft hand-over.

9. Method according to claim 8, wherein, in case said enriched initial solution has not a coverage area ($A^{service}_{Nactivecells}$) that is greater than said minimum area (A_{min}) and an amount of traffic ($T^{carried}_{Nactivecells}$) that is greater than said minimum traffic value (T_{min}), and the average load of cells in the potential network configuration is greater than a predefined threshold load, said solution is further enriched (230) by cells having a low load and candidate to "capture" the associated load to cells deemed in the "able to be turned off" status and having one or more adjacent cells in soft hand-over, in the potential network configuration.

10. Method according to claim 8, wherein, in case said enriched initial solution has not a coverage area ($A^{service}_{Nactivecells}$) that is greater than said minimum area (A_{min}) and an amount of traffic ($T^{carried}_{Nactivecells}$) that is greater than said minimum traffic value (T_{min}), and the average load of cells in the potential network configuration is less than a predefined threshold load, said solution is further enriched (235) by the most adjacent cells in soft hand-over candidate to "capture" the load associated with cells deemed in the "able to be turned off" status and having one or more adjacent cells in soft hand-over, in the potential network configuration.

11. Method according to claim 9 or 10, wherein, in case said further enriched initial solution has not a coverage area ($A^{service}_{Nactivecells}$) that is greater than said minimum area (A_{min}) and an amount of traffic ($T^{carried}_{Nactivecells}$) that is greater than said minimum traffic value (T_{min}), the initial solution is built as solution that minimises (250) the number of active cells among the obtained solutions (245), starting from the potential network configuration, by deactivating the cells:

having the lower sum of percentages of coverage area and carried traffic with respect to the total coverage area and carried traffic guaranteed by the potential network configuration, if, following such deactivation, the remaining coverage area and carried traffic are greater than their respective predefined minimum values; or

having the lowest coverage area, if, following such deactivation, the remaining coverage area is greater than the predefined minimum area, among a list of cells with

which the minimum carried traffic is associated, if, following such deactivation, the remaining carried traffic is greater than the predefined minimum traffic value; or

with which the lowest carried traffic is associated, if, following such deactivation, the remaining carried traffic is greater than the predefined minimum traffic value, among a list of cells having the lowest coverage area, if, following such deactivation, the remaining coverage area is greater than the predefined minimum area.

12. Method according to claim 2, wherein the step of generating the solutions neighbourhood (400) comprises the steps of:

- verifying (420, 430) the type of a predefined number of previous activation/deactivation moves; and

- building (425, 435, 440) a solutions neighbourhood through moves of the same type of said number of previous moves.

13. Method according to claim 12, wherein an activation move comprises the activation of a useful cell in order to remove coverage and/or traffic holes, or having a high adjacency parameter value in soft hand-over towards cells characterised by high cell load values.

14. Method according to claim 12, wherein a deactivation move comprises the deactivation of a cell having a lower cell load and having a high adjacency parameter value in soft hand-over towards at least one active cell characterised by a cell load value that is lower than a pre-established maximum value.

15. Method according to claim 12, wherein a deactivation

move comprises the deactivation of a cell having in soft hand-over adjacency at least one cell able to support the load and for which the ratio between carried traffic by current active cells and placed in pilot pollution by the cell under deactivation, and globally carried traffic by the cell under deactivation, is maximum.

16. Method according to claim 6, characterised in that a "restore" procedure (500) is performed for a solution in case it is impossible to build a non-empty neighbourhood of the current solution, in which the best stored solution (1900) during said iterations is "restored" (800).

17. Method according to claim 6, characterised in that a "restore" (500) procedure is performed for a solution in case it is impossible to build a non-empty neighbourhood of the current solution, in which a random solution is built (900).

18. Method according to any one of the previous claims, wherein the cost function (F_C) of a solution is expressed as weighed sum of a plurality of cost items, comprising items representing:

- the ratio between geographic area not served by the subset of active sites and the served area in the potential network configuration;
- the ratio between traffic not carried by the subset of active sites and traffic carried in the potential network configuration;
- the mean square deviation of load cells of activated cells, from the ideal cell load;
- the mean square deviation of the soft hand-over loads of activated cells, from the ideal soft hand-over load.

19. Method according to claim 18, wherein the cost function (F_C) of a solution includes a further cost item pointing out the ratio between global traffic in pilot pollution associated with the set of active cells in the examined solution and maximum pilot pollution that can be found in the potential network configuration.

20. Processing system for selecting a subset of sites within a set of candidate sites for activating one or more radio stations of a telecommunications network, comprising one or more processing modules (12) programmed for performing a site selecting method according to any one of claims 1 to 19, and an associated module (14) for evaluating the performance of the set of selected sites.

21. Computer program product or group of computer program products that can be executed by a processing system (12, 14), comprising one or more modules for performing a method for selecting a subset of sites within a set of candidate sites for activating one or more radio stations in a telecommunications network, according to any one of claims 1 to 19.

22. Method for planning a telecommunications network comprising a plurality of radio stations sites, including the selection of sites from a set of candidate sites through a method according to any one claims 1 to 19.

23. Telecommunications network, comprising a plurality of radio stations sites selected from a set of candidate sites through a selection method according to any one of claims 1 to 19.